FRBSF Weekly Letter

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Oil Supply Shocks and the U.S. Economy

The price of oil fell by more than fifty percent in the first half of 1986. This dramatic decline led many observers to predict that a surge in the growth of real output was just around the corner. Yet the predicted acceleration in real output growth has not materialized so far. On the surface, the economy's response to the large price decline appears to differ from what past experience would suggest. For example, the large increase in the price of oil in 1973 was followed immediately by a significant contraction in aggregate output. By the same token, the price decline of early 1986 should have led to a strong surge in real output growth by now.

In this *Letter*, we argue that past experiences with changes in the price of oil and subsequent changes in economic activity in the U.S. economy have been misinterpreted. This misinterpretation has resulted from a failure to consider the effect of changes in the foreign exchange value of the dollar. We use the oil price shock of 1973 and subsequent economic developments to demonstrate that oil price shocks do not appear to have had a very large impact on real output in the past — once the effects of the dollar exchange rate are taken into account. Consequently, it is not very surprising that real GNP has failed to grow rapidly over the past year contrary to what was widely expected immediately following the oil price decline.

Effects of oil supply shocks

Along with labor and capital, energy is an input to the production process, and oil is an important component of total energy sources. A decrease in the price of oil due to a sudden increase in available supplies, for example, allows businesses to increase the amount of oil they use. This increase in energy input leads to an increase in production.

A decrease in the price of oil has other effects as well. The drop in price redistributes income between the U.S. and the rest of the world because the U.S. is a net importer of oil. The decrease in the price of oil can be compared to a tax cut for consumers that leads to an increase in spending.

Within U.S. industry, an oil price decline redistributes profits from oil-producing to oil-consuming firms. Just as oil-consuming industries react to a decrease in the price of oil by increasing output, industries involved in the production of oil will react by decreasing output. A permanently lower oil price makes it unprofitable to explore and drill for oil in previously profitable locations. This leads, in turn, to decreased production in industries that supply oil-producing firms with inputs.

Thus, the overall effects of an oil price drop on real output will depend upon the relative magnitudes of the effects on oil-producing and oil-consuming sectors. While the price increases of the 1970s focused our attention on the oil-consuming sectors of the economy, the large declines in both production and employment in the oil industry following the large drop in the price of oil in 1986 suggest that the impact upon the oil-producing sector may be substantial as well.

Theory, while able to tell us how particular sectors will be affected, cannot predict the overall response of real output to changes in the supply of oil. To make such a prediction, we must examine what actually occurred after each of the shocks.

Unfortunately, casual examination of the events immediately following the oil price shocks also does not provide an unambiguous answer. The oil price increase of 1973 was followed by a substantial decline in the rate of output growth, with the economy entering a recession in late 1974. At that time, it seemed natural to attribute the recession to the large jump in the price of oil. Indeed, popular views of the effect of oil price shocks are based largely on an analysis of subsequent economic developments.

However, the picture was considerably muddied following the oil shock of 1979. Following that episode, real output behaved quite differently even though the percentage increase in the price of oil was of the same order of magnitude as in 1973. (Analysts generally attribute the brief

recession in mid-1980 to the imposition of credit controls.) And, as noted earlier, the events following the 1986 episode seem to contradict the developments that followed the jump in oil prices in 1973.

One important difference between 1986 and the earlier oil shock episodes has to do with the existence of price controls. These controls kept the domestic oil industry from benefiting from higher oil prices even after the sharp increases of the 1970s, while the increase in the price of imported oil had a negative impact upon consumers. Thus, only the negative aspects of the oil price increase manifested themselves. It is likely that in a deregulated environment the effects of an oil price increase would have been less severe than they actually were in the 1970s.

Yet this explanation does not appear to be the entire story. While the output of the oil producers has declined dramatically as a result of the sharp price decline of early 1986, there does not seem to have been a noticeable increase in the output of industries that consume oil — a response that we would have expected on the basis of past experience.

The dollar and the price of oil

Taking account of the role played by the dollar provides at least a partial reconciliation of these apparent contradictions in the response of real output growth to changes in the price of oil. The value of the dollar has an important influence on the price of oil because crude oil traded in world markets is priced in dollars. If the value of the dollar falls, oil-importing nations (other than the U.S.) will find that the price of oil in terms of their own currencies has fallen. Consequently, their consumption of oil will go up. At the same time, oil exporters will discover that the price of oil measured in their currencies has declined. They will therefore reduce the quantity of oil they are willing to supply at the prevailing dollar price. Both responses will tend to raise the dollar price of oil. Thus, all else being equal, a decrease in the value of the dollar will lead to an increase in the dollar price of oil, while an increase in the value of the dollar will lead to a decrease in the dollar price of oil.

Oil prices were relatively stable until approximately 1970, as was the dollar. Both "oil shocks" of the 1970s were preceded by large declines in the value of the dollar. And the large increase in the value of the dollar in the early 1980s was accompanied by falling oil prices. Statistical tests further confirm the existence of this relationship between oil prices and the dollar. Exchange rates account for close to half of the variation in oil prices over the period from the late 1950s to the end of 1985.

These findings imply that, given the behavior of the dollar, the price of oil would have increased in the 1970s and decreased in the 1980s even in the absence of OPEC. As discussed in a previous *Letter* (December 19, 1986), OPEC's influence lay in accentuating these movements, that is, in causing large, sudden jumps in the price of oil.

Implications

Analysts therefore may have overestimated the role played by OPEC induced supply shocks in determining the price of oil, and simultaneously underestimated the role of changes in the value of the dollar. By ignoring the effects of the dollar, they have mismeasured supply shocks and exaggerated the effects of a change in the price of oil on aggregate output. More specifically, some of the effects of exchange rate changes have been ascribed to changes in the price of oil. (Statistical analysis reveals that these effects are quite complex. For example, while a fall in the value of the dollar leads to higher real output initially, this is followed by a decrease in output that more than offsets the initial increase.)

Formal empirical tests on data over 1959-1985 support this view. While changes in the price of oil have a significant impact on real output when no other variables are taken into account, inclusion of the exchange rate noticeably reduces the impact of oil price changes on real GNP.

Examining the 1973 episode

Since the 1973 oil shock and the subsequent economic contraction form an important part of the popular understanding of the effects of oil supply shocks, we decided to re-examine the impact of oil shocks on aggregate output over that period — with explicit consideration of changes in the exchange value of the dollar.

Real output contracted shortly after the price of oil increased in 1973. However, that by itself does not prove that the recession was caused by the oil price shock since aggregate output is subject to many other influences. To isolate the

Chart 1
The Impact of Oil Price Shocks on Real Output

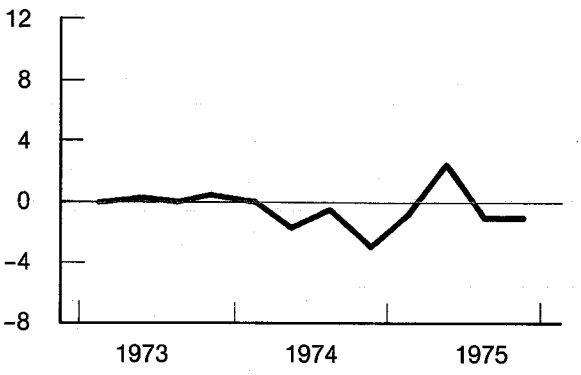
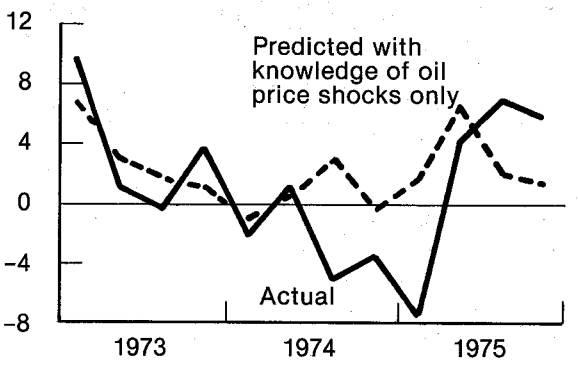


Chart 2
Actual and Predicted Real GNP Growth



effects of the oil price shock, we first forecast real GNP over 1973-75 using information about real output, inflation, the price of oil and the exchange rate up to the end of 1972 only. We then examine how this forecast would have changed if we had known about the unpredictable shocks to the price of oil over the same period. If the addition of these shocks leads to a large downward revision in the model's forecast, then we can conclude that the oil price shock had a considerable impact on subsequent economic activity.

Chart 1 shows how our real GNP forecast for the period 1973-1975 was revised when we added information about the unpredictable oil price shocks that actually took place. Oil price shocks appear to have exerted a negative effect on real output growth over 1974. They made their strongest impact in the fourth quarter of 1974, when they reduced growth by close to three percent (at an annual rate).

Would this impact have been sufficient to push the economy into recession? The answer is no. Chart 2 shows that real GNP decreased at an approximately four percent annual rate in the third and fourth quarters of 1974, and at close to an eight percent annual rate in the first quarter of 1975. The chart also shows the forecast of real GNP growth that we would have made at the end of 1972 had we known about the oil price shocks to come. The vertical distance between the forecast value and actual output growth provides a measure of the role played by developments other than oil price shocks in determining real GNP growth in different quarters during that period.

The chart reveals, first, that we would have predicted that the rate of output growth would slow down over 1973 and turn slightly negative in the first quarter of 1974. However, this pattern cannot be attributed to the oil price shocks since Chart 1 shows that the shocks actually had a slightly positive impact on real output growth over this period. Instead, our analysis suggests that the conditions for a slowdown in real output were already in place before 1973. Second, the chart shows that even with prior knowledge of these shocks, we would have predicted nothing close to the severity of the actual recession over 1974-75. Clearly, then, the recession during this period cannot be attributed to oil price shocks.

Conclusions

This *Letter* has examined the question of why the large oil price decline in early 1986 did not lead to an acceleration in real output growth. We have used the 1973 episode to illustrate the argument that, once the effects of exchange rate changes are taken into account, oil price shocks do not have a very large impact on aggregate output. Consequently, it is not very surprising that the large decline in oil prices in early 1986 has failed to produce a surge in real output growth.

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BANKING DATA—TWELFTH FEDERAL RESERVE DISTRICT

(Dollar amounts in millions)

Selected Assets and Liabilities Large Commercial Banks	Amount Outstanding 1/28/87	Change from 1/21/87	Change from 1/29/86 Dollar	Change from 1/29/86 Percent[7]
Loans, Leases and Investments[1] [2]	207,103	396	4,602	2.2
Loans and Leases[1] [6]	186,019	91	3,070	1.6
Commercial and Industrial	54,600	− 274	1,708	3.2
Real estate	67,038	− 6	1,138	1.7
Loans to Individuals	38,585	− 220	− 1,996	− 4.9
Leases	5,472	0	− 251	− 4.3
U.S. Treasury and Agency Securities[2]	13,920	285	2,924	26.5
Other Securities[2]	7,163	19	− 1,394	− 16.2
Total Deposits	205,378	− 3,920	6,773	3.4
Demand Deposits	50,635	− 3,445	5,001	10.9
Demand Deposits Adjusted[3]	35,660	613	− 6,223	− 14.8
Other Transaction Balances[4]	18,832	− 477	4,185	28.5
Total Non-Transaction Balances[6]	135,912	3	− 2,412	− 1.7
Money Market Deposit Accounts—Total	46,953	− 317	1,429	3.1
Time Deposits in Amounts of $100,000 or more	32,640	248	− 6,118	− 15.7
Other Liabilities for Borrowed Money[5]	26,764	− 1,724	− 573	− 2.0
Two Week Averages of Daily Figures	Period ended 1/26/87	Period ended 1/12/87		
Reserve Position, All Reporting Banks				
Excess Reserves (+)/Deficiency (−)	67	1		
Borrowings	15	3		
Net free reserves (+)/Net borrowed(−)	52	− 1		

[1] Includes loss reserves, unearned income, excludes interbank loans
[2] Excludes trading account securities
[3] Excludes U.S. government and depository institution deposits and cash items
[4] ATS, NOW, Super NOW and savings accounts with telephone transfers
[5] Includes borrowing via FRB, TT&L notes, Fed Funds, RPs and other sources
[6] Includes items not shown separately
[7] Annualized percent change